

Update to  
**Emissions from Incineration of PFAS and PFAS-related compounds**

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**Summary**

The minimal research on PFAS destructibility using laboratory simulations suggest thermal breakdown of PFAS-related compounds is likely under sufficient combustion conditions. Drawing a parallel with chlorinated organics such as polychlorinated biphenyls and polychlorinated dioxins/furans, these compounds would be broken down under combustion conditions. However, there is apparently no supporting field data to confirm these conclusions. Flue gas clean up devices on incinerators that target removal of SO<sub>2</sub>, HCl, and chlorinated organics would likely also be effective against fluorinated organics and HF.

**Basis**

A recently published paper (Watanabe, et al., 2018) on thermal reduction of PFAS related compounds to inorganic form (mineralization) indicated that “combustion [of PFAS compounds adsorbed to granular activated carbon] is expected to destruct PFASs, because PFOA in air stream at 700 °C resulted in 90 % mineralization at laboratory scale (Takemine et al. 2013a). Full-scale waste incinerator and cement kiln are reported to destruct chlorofluorocarbon with an efficiency of >99.99 % (Urano et al. 1996; Ueno et al. 1996) [both of these references are in Japanese]. Off-gas from incineration of textiles involving PFASs emitted no gaseous PFOA (Taylor et al. 2014). However, Watanabe’s experiments also suggested that their mass balance missed 9 to 26% of the starting material, presumably due to formation, release, and insufficient sampling/analytical methods for lightweight organofluoro compounds (C1 and C2’s). Their work was only at 700 °C – higher temperatures would be expected for combustion treatment and, according to the author, regeneration of activated carbon. Work at higher temperatures considered representative of combustion conditions examined the thermal stability of fluorotelomer-based polymers and emissions of PFOA (Yamada et al., 2005; Taylor et al., 2014). Temperatures at 1000 °C and residence times of 2 sec resulted in no detectable PFOA compounds indicating severing of C-F bonds. These results are consistent with our understanding: by design, the polar PFAS tail is easily thermally broken.

Watanabe, N. et al. (2018). Thermal mineralization behavior of PFOA, PFHxA, and PFOS during reactivation of granular activated carbon (GAC) in nitrogen atmosphere, *Environ Sci Pollut Res* (2018) 25:7200–7205, DOI 10.1007/s11356-015-5353-2.

Takemine S, Takata M, Yamamoto S, Watanabe N, Matsumura C, Fujii S, Tanaka S, Kondo A (2013a) Thermal behavior of perfluorooctanoic acid adsorbed on granular activated carbon. *Bunseki Kagaku* 62: 107–113 (in Japanese).

Urano K, Kato M, Kimura C, Tasaki T (1996) Decomposition of CFCs/HCFC in an industrial waste incineration facility. J Jpn Soc Atmos Environ 32:331–340 (in Japanese).

Ueno H, Tatsuichi S, Soufuku M, Iwasaki Y, Oiwakawa Y, Sasaki Y, Miyakoshi T (1996) Decomposition of chlorofluorocarbon 12 in cement kiln. J Jpn Soc Atmos Environ 31:88–94 (in Japanese).

Yamada, Taylor, P. et al., Thermal degradation of fluorotelomer treated articles and related materials, Chemosphere 61, 974-984 (2005).

Taylor, P. Yamada, et al. Investigation of waste incineration of fluorotelomer-based polymers as a potential source of PFOA in the environment, Chemosphere, V110, September 2014, Pages 17-22.